JOHN WAIHEE
GOVERNOR OF HAWAII

JOHN C. LEWIN, M.D.
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
HONOLULU, HAWAII 96801

In reply, please refer to:
HEER OFFICE
HK1291-M7

January 9, 1992

Mr. Harry Kim, Administrator
Hawaii Civil Defense Agency
920 Ululani Street
Hilo, Hawaii 96720

Dear Mr. Kim: Harry

Subject: Department of Health Review Comments on the PGV Emergency Response Plan

We appreciated the opportunity to meet with you on December 27, 1991, to discuss the Puna Geothermal Venture (PGV) Emergency Response Plan (ERP) and provide a written response to the points in letter which we discussed. Attached are the language changes we requested PGV to make following our meeting to address your points and our concerns.

With regard to hydrogen sulfide (H_2S) action levels and the use of these in the ERP, (point 1), we requested that PGV include language to clarify the use of one-hour average concentrations in determining appropriate agency actions (see attachment). The proposed changes emphasize that professional judgment will be used to determine if H_2S levels are likely to exceed "watch" or "warning" levels for an hour or more.

The decision to take action is, of course, a governmental responsibility shared between the Department of Health (DOH) and the Hawaii Civil Defense Agency. The most important information to use in applying professional judgment will be the "type" of upset condition reported, as described in the ERP, the likelihood of the release persisting, meterological conditions, and available air monitoring results.

With regards to your need for assurance that the ERP does not conflict with the related permits cited in the plan (point 2), please be assured that we have reviewed the plan to ensure it is consistent with all appropriate permits and their anticipated amendments. We have also recommended to PGV that copies of the permits and any references to the permits be deleted from the plan. This will simplify the document and may reduce the need to amend the ERP when a permit related to the facility is amended.

With regard to your concerns about vertical venting (point 3), unabated vertical venting will no longer be permitted. The permit also prohibits H_2S levels from exceeding 25 parts per billion (ppb) over a one-hour average and 10 ppb over a 24-hour average.

With regard to noise levels (point 4), permitted noise levels have been substantially reduced. There are three different standards for noise and these have different daytime (7:00 a.m. to 7:00 p.m.) and nighttime (7:00 p.m. to 7:00 a.m.) levels for both drilling and normal power plant operations.

For drilling, 55 decibels (dBAs) for daytime and 45 dBA for nightime are the standard and are established at the PGV property line. These limits apply to all drilling except for Well Pad E. Due to its proximity to the PGV property line, noise standards for Well Pad E are 55 dBA for day time and 45 dBA for nightime, measured at the property line of the nearest residence.

For power plant operations, the noise standards are 53 dBAs for daytime and 44 dbls for nightime at the PGV property line.

PGV has responded to all of our recommended amendments and has submitted them to the DOH. All appropriate programs have reviewed the attached copy of PGV's proposed revisions and concur with the changes specified.

Please contact me or Mr. Mark Ingoglia if you have any questions regarding the ERP. We would be glad to discuss these changes and any other questions you may have regarding the ERP anytime at your convenience.

We also look forward to your comments on the draft memorandum of understanding between our agencies relating to geothermal emergency response.

Thank you for keeping us informed of your concerns.

Sincerely,

BRUCE S. ANDERSON, Ph.D.
Deputy Director for Environmental Health

Attachment

DRAFT

2 REGULATORY AUTHORITY AND DEFINITIONS

2.1 Regulatory Authority

As discussed above in Chapter 1, this ERP has been developed specifically to satisfy Condition No. 26 of GRP 87-2, which requires a plan of action to deal with emergency situations which may threaten the health, safety, or welfare of the employees and other persons in the vicinity of the proposed project site. GRP 87-2 presents fifty other conditions of approval which, among other things, set limits on the amount of several pollutants that PGV may emit into the environment, ~~and also set limits on the ambient (environmental) concentrations of these pollutants which result from PGV's operations (see Appendix B).~~ So that the PGV Project will not become a nuisance to the community, these permitted emission limits and ambient concentrations are intentionally set at very low levels.

PGV has also been issued two permits by the Hawaii State Department of Health (HDOH), which similarly limit the emissions of several pollutants, principally hydrogen sulfide, and limit the concentrations that these pollutants can reach in the ambient environment as a result of PGV's operations. Authority to Construct ATC No. A-833-795 was issued by the HDOH to regulate the construction and operation of the PGV Project wellfield, and ATC No. ~~A-834-796 was issued by the HDOH to regulate the construction and operation of the PGV Project power plant (see Appendix B).~~

DRAFT

GENERAL CHARACTERISTICS OF HYDROGEN SULFIDE	
Concentration (ppb)	Characteristics
400,000 to 700,000	Acutely toxic
10,000	Acceptable worker exposure for 40 hours per week - documented eye irritant
1,000	[redacted] Hawaii Department of Health one hour average concentration limit for evacuation to protect public health and defined "Warning" level[1]
25	[redacted]

[redacted]

DRAFT

25	[redacted] Hawaii Department of Health one-hour average concentration limit for routine PGV project operations and defined "Watch" level
5	Generally recognized level of odor detectability

HDOH has set a one-hour average ambient air concentration of 25 ppb H_2S as the lower limit for requiring notification to the CDA, [redacted] and set an average ambient air concentration of 1,000 ppb H_2S as the lower limit for requiring evacuation if this 1,000 ppb ambient air concentration is to be reached or exceeded for more than one hour. For the purposes of this PGV ERP, these levels have been designated as follows: 25 ppb = "Watch" and 1,000 ppb = "Warning". [redacted]

DRAFT

FACILITY EMERGENCY RESPONSE PLAN
Puna Geothermal Venture 25 MW Power Project

Table 8-2. Summary of Modelled H_2S Emissions ORIGINAL

TABLE 8-2: SUMMARY OF MODELLED H_2S EMISSIONS				
RELEASE SCENARIO	MAXIMUM OFF-SITE (>0.2 km) DISTANCE FROM SOURCE (km) TO IDENTIFIED ACTION LEVEL		POINT OF MAXIMUM PREDICTED OFF-SITE IMPACT (>0.2 km)	
	"WATCH" LEVEL (25 ppb)	"WARNING" LEVEL (1,000 ppb)	CONCENTRATION (ppb)	DISTANCE FROM SOURCE (km)
TYPE "1" EVENTS (EXCEED ONLY THE "WATCH" ACTION LEVEL)				
1. Aborted vertical flow through diverter/muffler	0.8 km	N/A	40.3	0.4
9. Aborted vertical flow from the mud sump	2.8 km	N/A	57.1	0.4
8. Aborted vertical flow from the mud tanks	4.6 km	N/A	253.1	0.4
11. Unaborted noncondensible gas flow	5.8 km	N/A	938.7	0.4
4. Unaborted vertical flow through 13-3/8" casing	25.+ km	N/A	148.0	0.8
5. Unaborted vertical flow through 9-5/8" casing	25.+ km	N/A	148.0	0.8
12. Unaborted vertical flow through power plant steam release facility	25.+ km	N/A	190.6	0.8
6. Unaborted vertical flow through drill rig subbase	25.+ km	N/A	246.8	0.8
3. Unaborted vertical flow through diverter/muffler	25.+ km	N/A	403.4	0.4
7. Unaborted vertical flow through area of fractured rock	25.+ km	N/A	788.4	0.4
TYPE "2" EVENTS (EXCEED THE "WATCH" AND "WARNING" ACTION LEVELS)				
10. Unaborted horizontal flow through a 4" choke line	25.+ km	3.7 km	6,355[1]	0.4
9. Unaborted horizontal flow through diverter	25.+ km	6.7 km	12,758[2]	0.4

[1]Note that this scenario can and will be quickly controlled through closing valves to shut in the well, resulting in a significantly reduced emission rate over any one hour period.

[2]Note that this scenario can and will be quickly controlled through closing valves to shut in the well, resulting in a significantly reduced emission rate over any one hour period.

DRAFT

FACILITY EMERGENCY RESPONSE PLAN
Puna Geothermal Venture 25 MW Power Project

Table 8-2. Summary of Modelled H_2S Emissions

REVISED

TABLE 8: SUMMARY OF MODELLED HYDROGEN SULFIDE IMPACTS				
RELEASE SCENARIO	MAXIMUM OFF-SITE (>0.3 km) DISTANCE FROM SOURCE (km) TO IDENTIFIED ACTION LEVEL		POINT OF MAXIMUM PREDICTED OFF-SITE IMPACT (>0.3 km)	
	"WATCH" LEVEL (25 ppb)	"WARNING" LEVEL (1,000 ppb)	CONCENTRATION (ppb)	DISTANCE FROM SOURCE (km)
TYPE "1" EVENTS (EXCEED ONLY THE "WATCH" ACTION LEVEL)				
1. Abated vertical flow through diverter/muffler	0.9 km	N/A	40.3	0.4
6. Abated vertical flow from the mud sump	3.8 km	N/A	87.1	0.4
8. Abated vertical flow from the mud tanks	4.8 km	N/A	253.1	0.4
11. Unabated noncondensible gas flow	8.6 km	N/A	998.7	0.4
4. Unabated vertical flow through 18-3/8" casing	25.+ km	N/A	146.0	0.8
5. Unabated vertical flow through 9-5/8" casing	25.+ km	N/A	146.0	0.8
12. Unabated vertical flow through power plant steam release facility	25.+ km	N/A	150.6	0.8
9. Unabated vertical flow through drill rig subbase	25.+ km	N/A	148.8	0.8
2. Unabated vertical flow through diverter/muffler	25.+ km	N/A	403.4	0.4
7. Unabated vertical flow through area of fractured rock	25.+ km	N/A	759.4	0.4
TYPE "2" EVENTS (EXCEED THE "WATCH" AND "WARNING" ACTION LEVELS)				
10. Unabated horizontal flow through a 4" choke line	25.+ km	3.7 km	6,356[1]	0.4
3. Unabated horizontal flow through diverter	25.+ km	6.7 km	12,786[1]	0.4

[1]Note that these scenarios can and will be quickly controlled through closing valves to shut in the well, resulting in a significantly reduced emission rate over any one hour period. The decision to actually order an evacuation is typically made in the field by the appropriate responsible agency(ies) based not on waiting for field measurements to document that the established one-hour average "Warning" level has been exceeded, but on the professional judgement of the agency(ies), based on all the data available at that time, as to whether or not the incident has the potential to exceed the established one-hour average "Warning" level.

As shown in Table 8-2, ten (10) of the modelled release scenarios result in predicted ambient air concentrations in excess of the HDOH-established one-hour 25 ppb H_2S notification "Watch" action limit, but do not produce predicted results in excess of the HDOH-established one-hour 1,000 ppb H_2S "Warning" action limit. These include all of the uncontrolled well-related releases (scenarios 1-2 and 4-9) and the continuous power plant-related release (scenario 12). The short-term, or "puff", release of hydrogen sulfide and other noncondensible gases from the power plant also falls in this category. ~~Figure 8-1 shows the predicted maximum one-hour concentrations of hydrogen sulfide at several selected distances from the project sources chosen from all of these scenarios. Figure 8-1 shows the maximum predicted one-hour concentration of hydrogen sulfide at several selected distances from the project sources chosen from all of these scenarios.~~

The two well-related releases (scenarios 3 and 10) which have been modelled to exceed the HDOH-established "Warning" levels for one-hour hydrogen sulfide averages are unique from all the other well-related discharges in more than predicted maximum impacts. First, the high predicted impacts result from the horizontal nature of the discharge of the geothermal fluid; that is, the horizontal discharge of geothermal steam and noncondensible gases creates an impact significantly larger in a directly downwind direction than the same flow would if directed in a vertical direction. Second, each of these upset discharges can each be simply stopped or redirected vertically by either manually or remotely shutting in one of the upstream control valves even after the discharge occurs. Thus, although these two discharges have been modelled as if the discharge of geothermal steam and hydrogen sulfide would continue in a horizontal direction for more than an hour, through this modelling PGV has recognized that horizontal discharges of the geothermal fluid can produce unacceptably high impacts, and PGV can and will immediately terminate any such discharge if it occurs. Thus, any

DRAFT

ORIGINAL

Figure 8-1 Map of Predicted Maximum Off-Site Concentrations of Hydrogen Sulfide Selected Distances from Type "1" PGV Project Sources Under "Worst Case" Meteorological Conditions

FIGURE 8-1 IS LOCATED IN BACK POCKET OF DOCUMENT

DRAFT

REVISED

Figure 8-1. Map of Predicted Maximum Off-Site Distances to Modelled Ambient Hydrogen Sulfide Concentration From Each PGV Wellpad Under "Worst Case" Meteorological Conditions

FIGURE 8-1 IS LOCATED IN BACK POCKET OF DOCUMENT

Would you live near well? No problem with health but would be nursing problem –

Element II Emergency Response

III

check on noise

- KS 8 cause

DRAFT.

impact resulting from the short-term horizontal discharge of geothermal fluid will be short-term, and the actual hydrogen sulfide impact will be much less than that predicted in Figure 5-1.

The horizontal discharge of geothermal fluid modelled in scenarios 3 and 10 is ~~very~~ directional (that is, the magnitude of the impact depends upon the direction of the discharge and the direction of the wind). Figure 8-2 has been prepared to graphically show the focused nature of the emissions and impacts for scenario 3 from a single source.

A preliminary analysis of the possible impacts and health hazards which could result from the uncontrolled emission of the geothermal brine and noncondensible gases was also conducted by PGV and HDOH (see Appendix I). Based on this preliminary analysis, none of the non-H_2S components of the geothermal fluid appear to be released to, or formed in, the environment in concentrations high enough to significantly increase the level of health hazard created by the simultaneous emission of the H_2S. As a result, the levels of H_2S described above are used exclusively herein as the emergency response planning criterion. However, PGV will be undertaking a more detailed sampling and analysis program for these non-H_2S components during the first well flow test following acceptance of this revision of the ERP. PGV has committed to specifically review the new geothermal chemistry information with HDOH and revise the ERP as appropriate.

Response Actions

PGV will immediately notify the CDA and HDOH in the event that any of PGV's operations result in an uncontrolled steam release which produces, or has the potential to produce, an exceedance of the appropriate ambient H_2S concentrations established by

Received DOH emergency order limits

Dec 9 DOH letter to County Civil Defense agency

10 Task Force
DLNR approve Amended Plan of Op

11 DOH letters to Comm. agencies re Advisory (PA-HP)

27 DOH, Civil Def ERP issues

30 Mayor + Gov
DOH ATC for steam boil test

Jan 9 Relocation of DBED
DOH Response to
14 wells

14 Planning Director allows PGV to proceed with service test

16 Relocation Task Force meet with Comm. agencies

17 Met with Lyman, Craddick, Tommy (Mayor land agents)

21 Service test begins

22 "

Barry will make chronology available

ERP will trigger response more quickly now that new plans in place

DRAFT

8.2.3 Noise Hazard

Nature of Hazard:

Noise is not commonly considered a hazardous condition in any situation other than the workplace, although it is a nuisance and can, following repeated exposures at high energy levels, result in a degradation of hearing acuity. The Occupational Safety and Health Administration (OSHA) has set the permissible noise exposure at 90 dBA for an eight-hour day. [redacted]

~~The GRP (Condition No. 24) sets specific guidelines for noise for the PGV Project, which are to be enforced by the Planning Department (see Appendix B). In general, these limit noise levels from project operations at the nearest residence to 55 dBA during the day and 45 dBA (50 dBA from wellpads E and F) at night. Noise levels may be exceeded by a maximum of 10 dBA, but not more than 10 percent of the time. During periods of open geothermal well venting and steam pipeline cleanout, when the GRP application indicated that noise levels within 50 feet of the source could range from 75 dBA to 125 dBA, the GRP waived these noise guidelines, but required the application of Best Available Control Technology (BACT). In addition, the GRP (Condition No. 24) requires PGV to notify any resident within 3,500 feet of the property boundary requesting such notice prior to well venting or pipeline cleanout.~~

The most probable sources of high level noises during upset conditions would be a steam release through a pipe or pipe rupture and/or during a well blowout. In most cases, such

1/23/92

Geothermal Task Force

Re geo press releases - will coordinate County press release with State ~~appropriate~~.

Barry Higuchi requests State do likewise.

County releases will be released to community assns; BIRAG + HIGA

Who will take press calls from each agency -

DOH - Barbara Hastings

DLNR will check + let Michelle know 1/24/92

County Planning Director + Barry Higuchi

Since June 12 to now

log time more appropriate

11:06 pm Wed night

June 14 6:30 am well shut in

June 20 DOH permits suspended

July 25 independent tech water reports became public (at Pahoa)

26 Planning Director suspended all activities except KS 8

30 Mayor declared State of Emergency

Aug 7 drilling of HW3 began (water well)

20 1st Task Force meeting at OBED

23 " Civil Defense

30 HW3 completed pressure tested

Sept 5 received PGV's response to Task Force

10 temp logging at KS 3 - emissions

12 initial meeting of Gov's Task Force & Subcontr. included Pomeroy

18 PGV cited for KS-3 blowout, fined $3K

Oct 1 DLNR informed Mayor emergency over KS 8

2 Mayor ended Emergency

29 Planning Director - issued Well Stds.. re Wahee

Nov 26 Mtg at Civil Defense re geo emerg. planning